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A NEW METHOD OF REPRESENTING THE EARTH'S SURFACE

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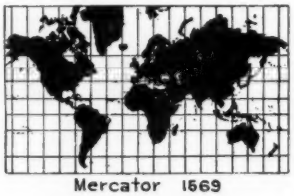
THE VAN DER GRINTEN PROJECTION:

IT is quite impossible to represent upon a plane any considerable portion of the earth's surface, without introducing a train of errors of distortion. The difficulties rise to a maximum when it is required to show the whole earth's surface at once. The problem is solved in many ways, with various degrees of satisfaction, but always if the truth be told in one respect it is grossly violated in some other. If directions are represented by right lines, then shapes and distances are sacrificed. If areas are true, then shapes and the relation of the lines of reference are violently misrepresented. So of the many projections, we choose one which is true along the line of the most conspicuous need in our presentation and shut our eyes to errors on other lines. For the mere satisfaction of having the habitable part of the earth's surface shown at a glance, and at the same time have parallels and meridians shown as straight lines, the so-called cylindrical projection of Mercator (1569), or some easy modification of it is most commonly used. In charting world-like distributions, as ocean currents, atmospheric temperatures, pressures and the winds, all of which emphasize latitude most conspicuously, this projection has a strong point. But always in the enormous exaggeration of arctic lands, or of the east-and-west distances in high latitudes. The constant use of the Mercator projection tends to teach this untruth of form and area, so that we of North America come to have some excuse for a sort of geographic "big head," as the common phrase runs, and I suspect that nine out of ten of us would answer off hand, that North America is a great deal larger than Africa.

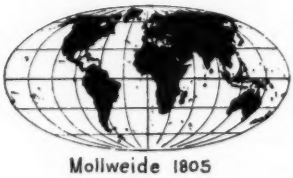
So, to guard against this common danger of exaggeration, Mollweide, in

1805 invented a method of projection which throws the earth's surface into an ellipse, having the length of a meridian for its minor axis, and the circumference of the equator as its major axis. The central meridian in this case is a right line, all other meridians being elliptical. The equator and all the other latitudes are represented by straight lines and parallel. Such a projection retains the advantage of having the parallels as right lines, and has a very great advantage in having equivalent areas, that is, a square mile



Mercator 1569

Van der Grinten 1898

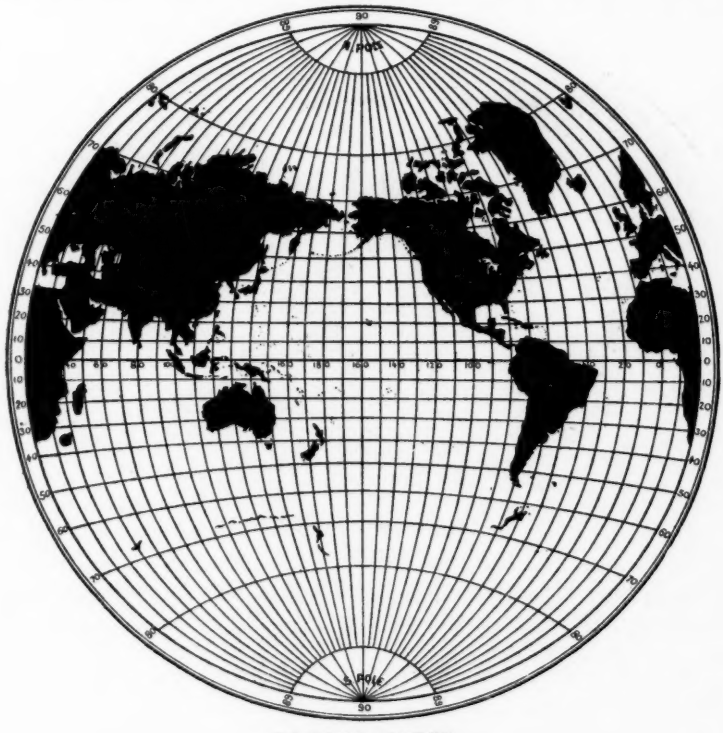


Mollweide 1805

occupies as much space in one part of this map as in any other. But shapes are grossly distorted in all the margins. Nevertheless, this projection is much used in German cartography, and with good reason.

Mollweide's invention was made a hundred years ago, and interest in map projection seems to have lapsed. But just before the century's end,

Mr. Alphons van der Grinten, a resident of Chicago, brought out a new projection, which is truly, as Prof. Dr. E. Hammer says of it, "a lucky stroke." For in this projection, Mr. van der Grinten strikes a happy mean between the extremes of Mercator and Mollweide by representing on one circle the entire earth's surface, in such a way as to reduce to a minimum the angular distortion of Mollweide, and at the same time to reduce at a proportional rate the distortion of areas and distances so prominent in the

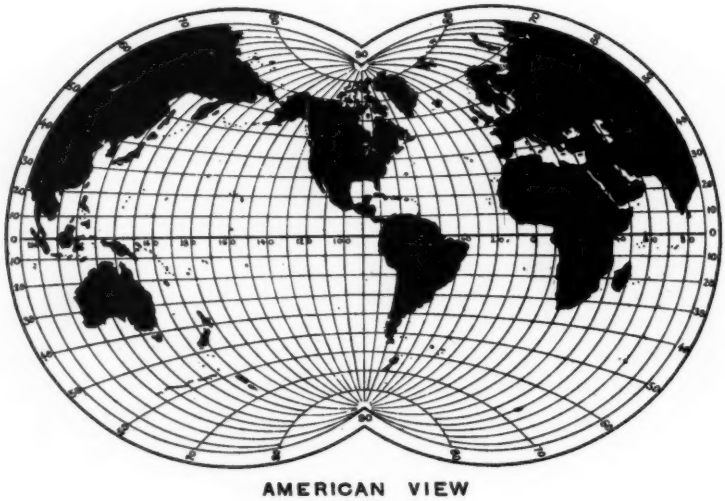


PACIFIC VIEW

Mercator projection. The scheme of projection is strictly geometrical, both parallels and meridians being represented by arcs of circles. The marginal meridian is a circle, and there is no distortion along the equator. The area of the circle occupied by the map is equal to the surface of a globe of one-half of the diameter of this circle.

It is to be noticed in this method, that all errors in projection are at a minimum at the equator and at a maximum at the poles, so that the continents fall within the zone of least alteration. And this suits our convenience, for our chief and most constant interests are in the lower latitudes, and for the most of our uses latitudes above 75 degrees could be ignored.

Of course any meridian may be chosen as the center of the map, and so any region may acquire the maximum advantage which the middle portion of the map gives. In Fig. 1 this advantage is gained for Europe, Africa



AMERICAN VIEW
$b=\frac{1}{2}$

and the Atlantic Ocean. In Fig. 2 it is gained for the Pacific Ocean, and in this view it is surprising how remarkably true space relations are shown for the Pacific and all contiguous lands.

Mr. van der Grinten has worked out a modification of this scheme of projection, in which the central meridian, instead of being equal in length to the equator, is only one-half as long. This gives an outline like the figure 8, and increases the accuracy of representation for the half of the earth's surface occupying the middle of the map. This method of projection very materially reduces the area of the page occupied by the map, and so has an additional advantage. When the meridian of 90°W. is chosen for the center, it gives us the best results of any of the projections heretofore used, for the display of the entire new world and the contiguous oceans

(Fig. 3). And if the meridian of 90°E. be chosen, it will give an equal advantage to the eastern continent. In this modified form the projection gives a much greater marginal distortion in high latitudes. But this is largely compensated for by the increase of accuracy in the 200° of longitude in the middle of the map, and in all longitudes in low latitudes.

These new projections have very high value. They have received the heartiest approval on the part of the leading German geographers, and have been published in the foreign magazines of highest authority. They should win their way into a secure niche in everyday use.

A MODEL SERIES OF BASE MAPS

BY J. PAUL GOODE

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WITH every active teacher and growing student the need is constantly rising for a base map for the entry of facts of distribution of one kind or another. Multitudes of these facts meet us all along the way. It may be the delineation of routes of commerce, or the movement of populations, the territorial expansion of governments, or productive areas in commercial geography. In all lines from common school geography and history, through civics, physiography, meteorology, commercial geography, politics and sociology, these needs confront us. For a map is a kind of shorthand, and expresses far more rapidly, and accurately too, the facts of distribution, than a long and tedious detailed description could do. And the map appeals to the eye, so adding another sense to the avenues of acquisition of knowledge.

But when we look about us to find blank maps upon which we may chart these data, they are not to be had, or are hard to find. It is true, a dozen publishers in this country issue series of outline maps intended for such a purpose. But to mention any one of them is to condemn it. As a rule they are atrociously drawn, they are printed with poor ink on inferior paper, and if our seventh grade pupils had been adequately taught they would be insulted to have such stuff put before them. The paper is thin and open, it takes neither water color, ink, crayon or pencil adequately, and the pupil's work when entered, is a smutch and a disgrace.

For a number of years the writer of this paper has been looking for a respectable series of base maps. They have not yet been found in the small size required for student note-book work. It has even been necessary to have some made to order to get decent paper and respectable drawing.

XUM

So it was with real pleasure, that a year ago Madden's "Thermo-Geographical Studies" brought to my notice a very beautiful base map upon which the author had charted some climatic data. The map was the northern polar cap down to latitude 30° N. in a polar projection, yet with the distortion admirably distributed. It was drawn with great accuracy, and meridians and parallels for each degree were shown. Lands were tinted a light buff, the seas were untinted. Drainage lines, mountain axes, and important cities were shown, but not political boundaries. The map was the first of a series, constructed by Lieut-Col. Axel Staggemeier of Copenhagen.

The series was sent for at once, and was promptly forwarded to me by Col. Otto Staggemeier, Kong George Vej. No. 12, Copenhagen. It proves to be an ideal set of base maps, and many another student may be glad to know about them.

The set consists of twenty-five sheets, 22x21 inches, on a fine quality of plate paper. The maps are lithographed and the workmanship is excellent. There is a line for every degree of latitude and longitude, every fifth one slightly emphasized. All the letter press is in English, in engraver's Roman.

The first five sheets cover the earth's surface, as general maps. First the north polar projection, down to latitude 30° N. (No. 1). This covers one-quarter of the earth's surface and is so free from distortion that one is glad to know the method of projection. The equator is the plane of projection (A. B.) and the point of sight is in the earth's axis, produced beyond the south pole far enough to make the equator subtend an angle of 60°. This, obviously, makes all meridians straight lines, and all parallels circles, and distributes the errors of projection as shown upon the equator in the accompanying figure.

One can see at a glance the very great advantage such a projection has as a base map. One may take out any section of it, balance it upon its middle meridian, and have it erect and well poised upon his page. And we all know the lop-sided appearance made by taking out any part of a map on the usual projections, unless it be the one strip along the central meridian.

The next three charts cover 120° longitude each on Mercator's projection, representing that one-half of the earth's surface lying between the parallels of 30° N. and S. The points of view are so chosen as to give an Atlantic face (No. 2), a Pacific face (No. 3) and an Indian face (No. 4). Chart 5 finishes the general set, with a south polar projection down to latitude 30° S.

The remaining twenty sheets cover the earth on double the scale, giving

us four sheets for the north polar quarter of the earth's surface, divided on longitudes 60° E.-30° W. (No. 6); 30° W.-120° W. (No. 7); 120° W.-150° E. (No. 8); 150° E.-60° E. (No. 9). Then the middle zone of

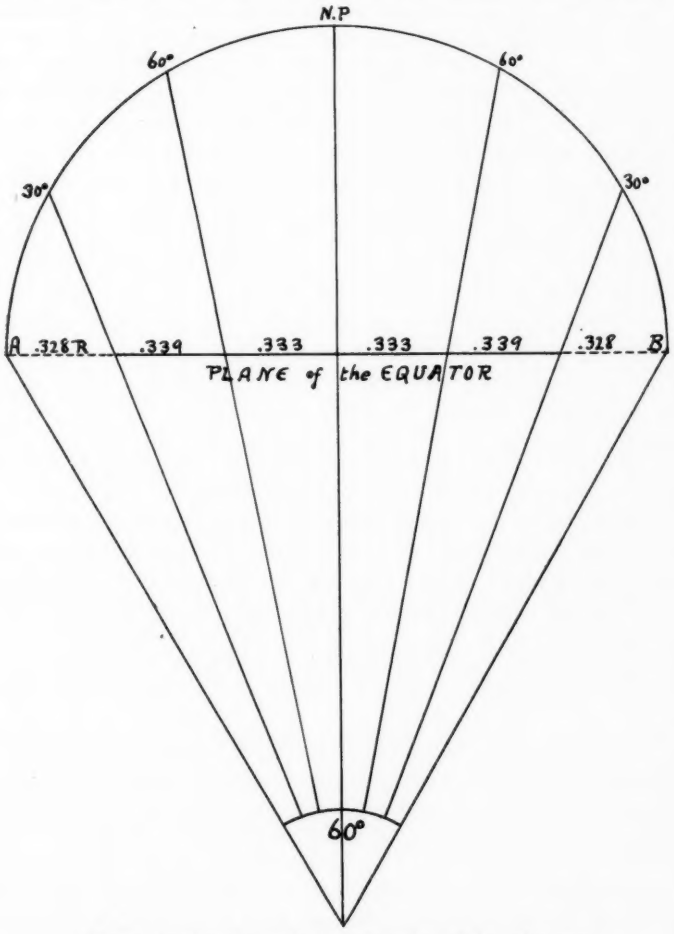


Figure showing the method of projection of the polar caps

lower latitude is covered in Mercator's projection, in twelve sheets, running from the equator to latitude 45° N. and S., as follows: N. 20° E.-40° W. (No. 10); S. 20° E.-40° W. (No. 11); N. 40° W.-100° W. (No. 12);

S. 40° W.-100° W. (No. 13); these four forming the Atlantic face. The next four:—N. 100° W.-160° W. (No. 14); S. 100° W.-160° W. (No. 15); N. 160° W.-140° E. (No. 16); S. 160° W.-140° E. (No. 17); give us the Pacific face. The middle zone is finished with another four:—N. 140° E.-80° E. (No. 18); S. 140° E.-80° E. (No. 19); N. 80° E.-20° E. (No. 20); S. 80° E.-20° E. (No. 21); as the Indian face. The final four give the quadrants of the southern cap, latitude above 30°; 60° E.-30° W. (No. 22); 30° W.-120° W. (No. 23); 120° W.-150° E. (No. 24); 150° E.-60° E. (No. 25).

It is indeed a satisfaction to know that somewhere upon the planet, strictly high class base maps are made, even if we do have to go to the bother of sending to a foreign country with its difference in money, and perhaps with a barbarous tariff added as a fine upon the spread of intelligence.

But it would not be fair, in praising this set of maps not to call attention to some most excellent base maps of the United States, which are available for the use of teachers and students. These are copper engraved, and printed from stone, very accurate and very beautiful. They are another example of the almost incredible generosity of our government, when it sets its hand to a line of educational development. The maps referred to are in a series of general maps published by the United States Geological Survey, address The Director U. S. G. S., Washington.

(1) Base map of the U. S. one sheet, 11x16 inches, 204 miles to an inch, polyconic projection. All water entered in blue. Rivers and lakes shown in considerable detail. State boundaries, and names, and names of some rivers and cities in black. On a fine quality of plate paper, which will take any medium from pencil to ink. These maps are sold at five cents each, or at two cents when taken in lots of a hundred or over. And of course carriage is free, for they are sent by mail, at the government's expense.

(2) Base map of the U. S. one sheet, 18x28, 111 miles to an inch, polyconic projection. Rivers, a very generous number, entered in blue. Seas and lakes in green. Land untinted. Culture data—boundaries, cities, names, in black. These maps are large enough for use in class demonstration. Distribution may be entered in ink, watercolor or crayon. They are sold at ten cents each, or for one hundred or more, at four cents. This same map can be had with contours at the same price, or it may be had tinted in brown to show relief, at the same price.

(3) Base map of U. S., 49x76 inches, in three sheets, scale 40 miles to the inch, polyconic projection, all water in blue, culture in black. State and county boundaries, county seats and many cities given, latitudes and longi-

tudes represented by a line for each degree. A very accurate and a very valuable map. It is sold for sixty cents, singly, or at twenty-four cents in lots of a hundred. This map with railways, and contours of 100, 500, 1,000, 1,500, 2,000 feet and upward in thousand foot intervals, may be had at the same price. There could scarcely be a better map for school and general use.

It is very encouraging to have such fine maps available at such a generous price. The 11x16 map really comes within the possibility of individual use in class work, and the 18x20 map is ideal for the teacher's use in class demonstration, and is easily within the limits of his purse. But this is the end of the list. There is nothing else first class on the market in America. The regulation map on sale for the purpose is so bad, one would believe it if it bore the press mark of the "Gully Sunbeam." To put such stuff before an eighth grade student properly trained in graphic expression would be like giving a wood carver in the Pullman shops a plank from the sidewalk and a pick ax to work with. A base map for student use should be done in the highest quality of the draughtsman's skill, and of the pressman's art. It ought to be *right,* and in quality beyond anything the pupil may hope to do. By no means should it stand in the way of his best expression. It ought to be an example and a stimulus to him, to do his best in working with it. When shall we ever have such a series?

DIRECTION ON MAPS

Any teacher, no matter how untrained she may be in the use of map projections, ought at least to know that straight lines drawn from the right side to the left side of a map are not necessarily east and west lines. She should realize that the continuous black lines extending more or less across the map are east and west lines and that the similar lines extending up and down are north and south lines. Hence direction may easily be studied within the small irregular rectangles enclosed by two meridians and two parallels. These points need to be kept clearly in mind especially in wall-map work by pupils. Such problems as the direction and flow of the Yukon River or the St. Lawrence River ought to be studied as related to the meridians and parallels and not according to the sides of the maps merely, as is usually done.

Any teacher ought also to know that on a Mercator map areas in high latitudes are grossly exaggerated and that a Mercator map should not be used for comparison of areas. Neither should it be used for comparison of distances, though it is accurate in reference to direction. A teacher who studied distance according to scale would soon find that a Mercator map could not be used in this way because no scale would be found.

XUM

WHAT THE CIVILIAN MAY SEE OF GIBRALTAR TO-DAY

BY FELIX J. KOCH,
Cincinnati, O.

THE recent flirtations between the Powers and the Sultan of Morocco, coupled with the German Emperor's stop at Gibraltar and Tangiers, and the renewed rumors that the great fortress, guarding the entry to the Mediterranean is not nearly so strong as has been supposed, is turning the eyes of the world once again to Gibraltar. Gibraltar the fortress has been pictured times out of number, but it is a secret, known to comparatively few persons, that nestling within the shelter of the rock, lies one of the most cosmopolitan and picturesque cities of the world. Only certain liners pass Gibraltar in the daytime, and still fewer stop at the Rock; while the most of the tourists aboard the latter are, at such times, content with visiting the fortifications alone, so that Gibraltar city remains unknown.

A day in the neighborhood of 30° 59′ N. Lat. and 5° 34′ W. Long., as naval men speak of the Rock, is one of the interesting reminiscences of a Levantine tour. After almost nine days away from New York, in which 3,200 odd knots of sea have been traversed, passengers from the States awake to a cloudy sky and a gray-blue sea, scattered with innumerable sail-boats. They have been told that this day they should see the Rock, and many an innocent is eager to catch first sight of the sign he has been led to believe is painted upon its side. Nine persons out of every ten expect to see a narrow peak alone, and those who look for more anticipate a rock-formation that is black throughout.

About ten dim land forms appear on either side, marking the coasts of Morocco and Spain, and bringing forth the spy-glasses and cameras. Gradually these shores grow to mountains, just a trifle darker than the clouds above, bending off in low foot-hills, with wide yellow beaches below; and one great, blue-black range behind, the palm-trees, clear-cut against the sky on the crest of its highest summits. The nearer African shore runs gently back into mists which here enshroud everything, tingling the cheeks of the voyager and rippling the sea into white caps. The Spanish side, too, grows low, resembling some huge crocodile basking in the water,—with smooth, yellow areas along the base of its hills, and a lazy Spanish gunboat patrolling the coast beyond a small, white lighthouse. Patches of grain high up their slopes, divided by faintly-marked hedges, so closely resemble desert wastes as to recall at once "Gibraltar's golden sands" to the passers on the boats.

Once in sight of the pretty, white-walled, red-roofed town of Tariffa, whence our word "tariff" takes its name, and inside the Strait, boats slacken speed, and, in contrast to the lower Spanish dunes, the African mountains go slowly by, in ever taller peaks,—one of them rising almost to the clouds. Then Gibraltar rises into view, growing ever nearer, while the Dark Con-

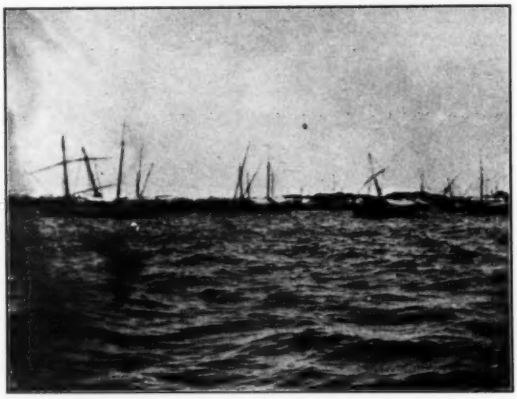
Gibraltar as we usually see it

A different view of the Rock

tinent, for a moment, disappears 'round a bend, and, returning, causes the Strait to resemble a wide river, down which the boat continues its sail. This bit of landscape, which will some day figure so prominently in the eyes of the world, is almost unknown to print, and the vast majority of

travelers come to the Strait expecting one even waterway of an average width of nine miles. Such it is only near its close, when, at quarter of one the anchor is dropped off Gibraltar itself.

Gibraltar, from this first mooring place, is not the single, jagged peak one always sees in the pictures. Instead, a great, billowy, sandy-yellow rock,—its slopes of tan and brown rolling as might some desert hill, up to an old castle on the sky-line; with curious ribbons marking the roads and an occasional tree-clump or long, retaining wall between,—greets the onlooker. Half-way up, at one point, are the ruins of an old Moorish castle, and almost level with these, at another, the trees of the Gardens give variety to the scene. At the base of this façade of the Rock, however —quite to the



Moorish Feluccas

surprise of the newcomer —rises a compact, gardenless town, white-walled, red-roofed, and densely set, as is the Moorish style. The new docks and the breakwater, with its latticed sheds running far out into the Strait, in fact, seem the only mark of present-day architecture about this curious hamlet. Coal steamers of but a single deck and that fitted with a Dutch wind-mill, are anchored in the slip, with a warship or two, and a fleet of sails for company; but of people or even a curl of smoke, to betoken human activity, there is not a trace; so that, to all appearances, the town might be some petrified city, or a part of the long, tawny rock behind. Over to the right the hills curve about in pale, romantic blues iridescing into a pinker haze, matching the yellow of the beaches; but there, too, of life there is no sign.

The picture, beautiful though it is, usually palls on the stranger, for he is apt to see it from *afar* much longer than he cares to. Landing regu-

lations are rather strict, and red tape consumes much of the short space of time that steamers spend here to take freight. An officious little skiff brings out the port doctor, and if there be a case of contagious disease in the steerage, as there usually is on a liner, the yellow flag is flown, and it is quite probable that no passenger saving those going on to Morocco or Spain will be permitted to land at this port; so that folk gather round the raised gangplank in disconsolate companies to bemoan their ill-luck. Possibly a second physician will be summoned, and after a tantalizingly long parley he will succeed in urging the other to allow all but the third cabin passengers to land, during the short space of time remaining for the cases and casks and the many sewing-machines from America to be taken off for this port. Incident to such permission is another long shifting of position, the boat coming to rest, about twenty minutes to two, opposite the heart of the city and within sight of the triangular peak that is usually pictured as Gibraltar. But a sheet of pale-green water, turning to blue beyond the ship, separates the tourist from the sand-colored rock. Whether or not it be true that Gib. is to-day no longer impregnable, the ranges of modern guns permitting warships to bombard from sheltered, inaccessible nooks beyond, Gibraltar evidently succeeds in keeping off some one thousand Americans by the word of two unarmed physicians alone. So tedious, in fact, becomes the wait that the traveler ceases to care whether he stops at Gib. or not; contenting himself with reading his guide-book, and patronizing the venders of the sea-grass baskets of fresh strawberries, figs or pears in the little skiffs all about, and the sellers of fans of feather work or bearing pictures of Spanish bull-fights.

Then, finally, at half past two permission is given and the lighter arrives, to take folk from ship to shore. Tourist parties gather to meet the guide stationed here for their benefit, while other folk form little companies for the hack tour of the Rock. Guides are ever aboard the lighter, looking for the latter class, and niggardly fellows they are, for the most part, refusing to answer the simplest question, (even as to naming the style of ship known as felucca), to those not hiring them. A great side-wheel steamer slips past on its way to Tangiers; and innumerable wine-vessels scurry from the path as we sail in blissful innocence over the most powerful submarine mines in the world.

On the wharf, curious high-wheeled hacks of yellow, a cross between a stage coach and jinrikisha, drawn by donkeys of Moorish breed, await; their drivers inordinately polite and as inordinately great swindlers, so that one must bargain closely and by the hour, or he will come out at the short end of the deal.

XUM

Gibraltar city, through which one is driven, is a curious place. Narrow streets wind between homes shimmering with their wealth of white stucco in the sunlight. Side by side, at the very curb—for pavements are unknown—are these houses set, the lower floors given over to a bazaar through whose open doors one may look over the entire stock *en passant*. So narrow are these streets that the congestion at times is worse than at Constantinople; while so steep are the inclines they ascend that the guide is forced to dismount and assist in pushing the wagon up hill. Mules and muleteers block the path, and in disputes over the right of way on especially steep hill slopes, upsets of the carriages are not at all infrequent, and many an

Street-car service at the Rock

American tourist-invader has come away from Gibraltar with an injured limb or sprain, to say nothing of broken jewelry as a memento of his inglorious downfall.

The real sight of Gibraltar town is its curiously conglomerate population. Oddest of all these peoples are, of course, the Moors—brown skinned fellows from Tangiers, in tall peaked hoods that rise from long, brown gowns floating down to the pale yellow sandals. Here and there a turban supplants the hood, or a white robe the gown, and the latter is bound in with a gay silken cord at such times. Christian Armenians are numerous, their ruddy complexions curiously white in contrast, as they mingle with the darker folk—in blouse and bloomers reaching to tight-drawn hose and dainty leather slippers. British soldiers are, of course, ubiquitous; there are 10,000 of them on the Rock, handsome in summer uniforms of tan and broad yellow hats of felt. Little English school boys, officers' sons, also wearing suits of yellow, or gay French gentlemen on a summer visit, in suits of black

and with beaver hats, are also conspicuous. English ladies of high birth ride in saddle through the streets on steeds from the cavalry stalls, driving from their path the hawkers,—pedestrians with panniers of flowers and fruit, or drivers of burros bearing trays of these wares.

With all this mixture of peoples, however, the silence of the East prevails, and the Westerner cannot conceal his astonishment at the comparatively universal quiet.

Set among the shops of lace-work and bric-à-brac, souvenirs, photos and post-cards, are a Catholic and Protestant church, between whose shadows the American flag now floats, for the Stars and Stripes have entered

A Moor from Tangiers

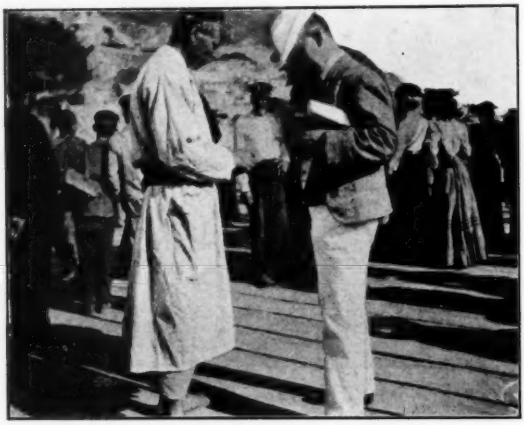
Gibraltar to the extent of a Consulate,—a two-story building, square and of stucco, as are most of the better class houses, with lattices at the windows to withstand the heat. Just beyond are the Alameda Gardens, a dusty park of oranges and olive and blooming oleanders, set among terraces overhung with blue morning-glories that would be pretty but for their dense coating of dust.

From these the road winds up to the Citadel proper, at whose entry the kodak must be surrendered. There, too, the American invaders quietly permit the British sub-lieutenant to tell them off in parties of ten, while young English officers take charge of each lot and lead the way up a steep dusty pathway of gravel, built among tangles of half-parched wild olive, in which, rumor has it, wild apes still thrive, and between whose boughs magnificent bird-eyes are caught, of the harbor encircled by the low blue mountains just across. Ever higher, ever warmer, ever dustier and tire-

XUM

some is this climb to the Galleries, the one section of the fortress itself that the civilian is permitted to visit.

Through arched passageways of solid stone, with side-aisles leading into the rock at every dozen feet on the right, and a porthole giving views of the harbor on the left, the visitor is led. Mammoth cannon are placed before most of the windows, in niches cut from the solid rock, and at these points one is forbidden to quit the main path. Barrels of water and cases of supplies sufficient to resist seven years of siege alternate with pyramids of shot at the sides of the trail of stone. Since her coming into possession in 1704, England has had abundant opportunity to prepare for war and she has improved upon it.



Christian Armenian and Tourist

Occasionally the galleries lead out into the open and then again into the rock, and one wonders, instinctively, how many armed feet have trodden these halls and how long before martial feet, such as these, will pass through here in actual warfare again. Just within sight of the Commandant's home and a memorial monument, the third gallery begins, and the stranger is forced to retire. So much and no more of the honey-combing of rock is it graciously permitted him to explore.

Returning by the self-same route to his carriage, and again to the heart of the town, it is the usual routine to make a stop at the Post-Office to mail a few views of the Rock; and then, if time permits, to drive out to the "neutral ground," separating British soil from Spain,—returning in season for a ramble afoot among the shops and a chance kodak-shot of the

Moors, who leap or bound out of range so soon as aware of one's purpose. London papers, bearing the first news of the world received in eight days, are on sale on the dock, and wrapped up in these, the tourist sits on the wharf overlooking the magnificent harbor, on the one hand, and the play of the sunset on the Rock on the other, awaiting the tardy lighter. At half after five the tug returns to take the American invader back to his ship where the band is playing the British airs and the British flag floats from the mast-head. Cool lemonade from the Moor's own fruit wipes the last trace of British dust from his throat, and at six he is ready to bid Gib. adieu.

Bit by bit, while dinner is served, the Rock is left behind,—one façade after the other appearing and as rapidly disappearing, as the vessel enters the Mediterranean; and after the evening game of pedro and whist it has almost sunk from view. Nor is one really regretful of deserting the neighborhood, picturesque as it is. It is just a trifle too much like living at the brink of a dormant volcano. In these days of the Balance of Power any war between the nations of the earth may involve Great Britain, and almost any such war must involve Gibraltar. And yet, like the happy Neapolitans and the mulattoes of Pelèe, the people of Gib. go on day by day in the shadow of this engine of incalculable destruction, heedless of any sudden political crisis may bring.

MAP FILLING vs. MAP DRAWING

Expert teachers of geography disagree as to the value of map drawing in school work. Teachers who are able to draw maps skillfully and accurately can easily teach children to draw creditable maps. Teachers who cannot draw good maps themselves should give little attention to map drawing but much more to map filling.

Pupils will see facts of location placed on a map which is visualized in their mind. Hence the necessity of having the base map, which children use for showing their knowledge of distribution and location as accurate as possible. The maps that children can make will, as a rule, be more crude and inexact than the outline maps, themselves of no high grade, that can be bought on the market. The filling of maps so as to show the pupil's knowledge of distribution of facts already studied, is a valuable means of summary and review in almost any lesson. The completed map should obviously be as correct as possible and should be produced quickly. Map drawing is generally therefore less valuable than the filling in of outline maps, because the final results from the outline maps are more nearly correct, give a better visual image to be retained in the mind, and have been acquired with the least waste of valuable time.

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THE SCOPE OF GEOGRAPHY[1]

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THE position of any subject in the school curriculum depends upon its appraised educational worth. Sometimes the mirror of values is turned toward the future, at other times it claims to reflect the present. Geography has moved up and down the scale of educational importance since the time of the cultured Athenians, disappearing entirely from the curriculum when its import was low, returning when the public interest expanded from local to international concern, or when the physical and intellectual life of the people was focused into the same era of time. Geography has never occupied the first place in the school curriculum as a cultural subject, but in rare instances its utility has given it the highest standing, as in the school of navigation established by Prince Henry at Segres in the fifteenth century, and in modern times in the colonial schools maintained by certain European governments. The educational status of the subject has not been due to its content, but to its pedagogy. Teachers have looked upon it as a collection of facts which could be memorized; and if action rather than speech can be taken as a reflex of thought, the majority of the army of teachers still maintain this conception. This does not refer to the superior teachers in every department from the kindergarten to the college, but to the great teaching body which shapes our educational policies. This statement is not based upon deductions from pessimistic theory, but from work seen during the last few years in schools located between the Rocky Mountains and Newfoundland.

The slowness of the progress of educational ideas is realized when we read what Comenius said more than three centuries ago: "We know the elements of geography when we learn the nature of the mountains, the plains, the rivers, citadels, or states according to the section of the place in which we were reared." I doubt if the pedagogues of Comenius' day lent responsive ear to his teaching, but once a true chord is struck it vibrates forever.

A century and a half later Rousseau took up the strain, and in his "Emile" says: "Let him learn his first geography in the town he inhabits, stimulating his imagination by expressing wonder as to natural phenomena."

One hundred years ago Pestalozzi did more than point out the way the

[1]Reprinted by permission from Elementary School Teacher, January, 1904.

pedagogically redeemed should go. He, rising higher than most educational philosophers, tested by practice his inspiring theories. Professor Louis Vuillemin in "Remembrances" describes the method of geography teaching when Pestalozzi had his school at Yverdon, Switzerland. He says:

"The first elements of geography were taught us on the soil. As a beginning our walk was directed toward a narrow valley, in the neighborhood of Yverdon, through which the Buron flows. We were made to contemplate it as a whole and in detail, until we had a true and complete mental picture of it. Then we were each invited to lay in a store of clay which was found on one side of the valley, and we wrapped it up in large sheets of paper we had brought for the purpose. On our return to the castle the long tables were divided among us, and we were left to reproduce in relief the valley which we had just studied. The following days brought new walks and new explorations, each furnishing a higher point of view, and each time a fresh extension was given to our work. We went on in this manner until we had accomplished the study of the basin of the Buron, and from the height of Monte La, which completely overlooks it, had grasped it in its entirety; and not until we had finished our reliefs, then, but only then, we passed from the relief to the geographic map, not being shown it until we had thus acquired an understanding of it."

This, so far as I can find, is the beginning of field work, which has been carried to a greater extent in Switzerland than in any other country in the world.

Ritter made two visits to Pestalozzi's school at Yverdon and was much gratified by what he saw. He says:

"I have learned to value that method which is based upon the nature of the child....it is now my business to bring this method to bear within the domain of geography. There is between nature study and history a great gap to be filled up. I have left Yverdon firmly resolved to fulfil the promise I made to Pestalozzi, namely, to apply his method to geography."

The United States owes to Karl Ritter an especial debt of gratitude, not only for his inspiring books, but for the instruction he gave to his excellent pupil, Arnold Guyot, who brought reform in geography teaching to this country. Harvard little knew what she was doing for the schools of America when, in 1848, she called from Europe that great teacher.

Mr. W. A. Alcott wrote in the "American Journal of Education" in 1858:

"Prior to this, geography as a science had received little or no attention in the United States. A few schools studied Morse's 'Geography,' a

few others used a sort of reading book by Nathaniel Dwight, known as 'System of Geography,' which was arranged in the form of questions and answers, but the majority of schools paid no attention whatever to the subject."

In 1825 Mr. Woodbridge and Mrs. Willard published a geography which was much in advance of those then in use. Immediately afterward Mr. Woodbridge sailed for Europe, being the first American who ever traveled abroad to enrich geography teaching.

The learning of boundaries and capitals, the location of cities and rivers was the burden imposed upon the memories of helpless children. Some ingenious teacher, realizing the unspeakable drudgery such a task demanded, devised the plan of singing the geographic text to stimulate the flagging brain over the tedious road, just as the band plays to aid the wearied soldier on his march. I cannot find the name of the author to whom the honor of that most humane invention is due, but the method prevailed in many places in the States throughout the fifties and early sixties.

In 1866 Guyot's "Common School Geographies" appeared. The teachers were poorly equipped for using them, and in the majority of schools the books were unintelligible. Hence, Guyot's "Geographies" proved a financial failure. Mr. Tucker, of New York, in a letter written recently said: "Colonel Parker, of Quincy, Mass., was one among the first teachers to take up the work of Guyot. It was in Quincy that he introduced modeling as a means of geographic expression."

Only within the last decade in this country has geography been able to rear its modest head into the ethereal realm of intellect dominated by mathematics, and to move in the exclusive set of culture, presided over by literature, art, and foreign languages.

According to the dictionaries, "geography" is derived from two Greek words, γέα, "earth," and γραφή, "description," and I think we may say the progress in the teaching of geography has been shown in the transfer of the stress in the pronunciation of the word to the "gea" instead of the "graphe," crudely to interpret a statement once made by Professor T. C. Chamberlain. In the study of the "gea"—the earth—there is a demand for the training of all the senses which the study of the "graphe" precludes. Preyer says: "The fundamental condition of all mentality is activity of the senses." Unless the perceptive faculties are trained, thinking will be defective and judgment unreliable.

Since the study of geography was and is relegated principally to the middle grades in the elementary school, the pedagogy of the subject has been in harmony with psychological beliefs. Reason was thought to be a

function of maturity, while the faculty of memory characterized the youthful mind. With the progress of child-study has come a change in the attitude toward the subjects of study. It has been found that even young children are interested in causal relations. Mr. Earl Barnes reports, as a result of his tests with thousands of children, that the majority are interested in the use of a thing rather than in its form or color; they wish to know the relation of things in this great world about them. It is in the intelligent conception of causal relation that we find the superiority of the civilized man over the untutored savage. It is not in the mere statement of causal relation which the child may memorize that he finds pleasure, but in the solution of a problem—the problem, his problem, and not that of a teacher—that he finds the greatest satisfaction. Children, as well as the adult, like to reason from known data to unknown consequences.

The belief that memorized facts stored away in the mind will be ready for use at a convenient time, has hypnotized the best of us. We are daily surprised at the emptiness of the intellectual storehouses of our students, into which we have previously poured a wealth of choicest facts. We fail in the pedagogical application of our knowledge of psychology for the self-same reason, that the pupil finds his facts unusable. It was not acquired through action. We forget that images which make up the fabric of vital thinking must be related.

Dr. Dewey says:

"Knowledge may be regarded as a sort of bridge, or connecting link between some difficulty in action and a further successful or harmonized activity. Its significance lies in this intermediate position; that, when knowledge is isolated from its origin and its goal it becomes artificial. From this point of view, we do not know how it came into existence, or for what it exists; in being made an end in itself it is made unreal. Knowledge is reduced to information, a load or burden of facts, which the individual has to carry without intelligent purpose."

The student discovers too late that ordinary unrelated knowledge is not power; that only scientific knowledge—unified, related experiences—are valuable.

The test we impose to discern the ability of our students is as fallacious as our knowledge-giving plan. We too often measure the student's power by what he can say, while the world classifies him by what he can do. Life justly criticises our pedagogic results.

The measure of progress in teaching geography is nowhere more strongly marked than in the use of field work. It was begun by Pestalozzi, but has made more headway in this country during the last decade than during

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all preceding time. Yet when the number of schools doing field work is compared with those which never leave the school buildings, the percentage is distressingly small. Field work has become an almost universal practice in the classes in geology and botany of the best universities of this country, and in some of the high schools a few excursions are made yearly. But in the elementary schools, in the majority of districts, field work is unknown. Why the teaching of Comenius, Rousseau, Pestalozzi, Ritter, Guyot, and others, together with that of all our noted modern geographers, has failed to impress the lesson of field work upon the teaching body, finds its answer, I believe, in four separate causes: (1) The lack of appreciation by the teachers and the parents of its value in illuminating the geography work. (2) The timidity of the teachers in meeting difficulties which the field presents. Few teachers have been trained to read the expression of the world which lies about them; hence they naturally shrink from placing themselves in the position of instructor before a class of active, inquiring minds facing real, natural problems. (3) The physical strain of taking care of, say, forty pupils outside the school room without proper assistance. (4) The expense which is necessarily incurred in visiting places beyond the walking distance from the school building. We know, however, that, if this objection is reduced to its lowest terms, it is not insurmountable. If field work were considered as valuable as other forms of instruction, the expense would not be prohibitive. The American people, have, on the whole, what they truly want. Look at their school buildings and equipment! If we actively desired field work, it would be a part of every school curriculum. We passively want clean streets and good civic governments, but not until we make our demands active will they be granted. The majority of people really believe knowledge is acquired from books. Hence, if children can recite the contents of certain books, they are educated. Books certainly have the greatest function in our modern civilization, but we are all fortunately, or unfortunately, so constructed that we can read from books only our previous self-experience. It is the grossest absurdity to expect the child whose sky-line is an eternal stretch of irregular roofs and whose landscape is made up of dirty alleys, to appreciate the meaning of broad stretches of rolling prairies, dense tropical forests, and high, snow-capped mountains. Yet we find the books which are given to these children who are so unfortunately situated containing the same text as that provided for the children who spend their summers in the country and who travel some part of every year. I believe if the money spent on the geographies for these poor districts was devoted to field excursions, under the direction of

skilful teachers, there would be a much larger intellectual and moral return in citizenship than is received from the present investment.

With the best possible conditions the present geographic text is not what we wish it were. There has been a great improvement in the last few years; yet there is still much to be desired. Since advance in geography teaching has been largely in the universities, the best texts have been produced for the colleges. Many of the best books written for children have been the work of college professors, and in some cases they are illy adapted to elementary schools. As in everything else, we have a heavy geographic burden due to inheritance. The old cosmographies which were produced during the fifteenth and sixteenth centuries have, I believe, had no small effect upon the geographies of to-day. The modest title of one by Sebastian Munster, which appeared about the year 1534, illustrates their comprehensive character. It reads: *Cosmography—A Description of all the Lands and States of the Whole Earth—Its People, Animals, Products, Governments, Religions, etc.* Notwithstanding the growth of geographic knowledge, which bears in upon us as we read some of the astonishing statements in this popular work which went through twenty-four editions—such as, "the German Ocean is an inland sea," "Iceland is joined to Norway" --we might still put the same title on the cover of many geographies used in our schools to-day. We have attempted to boil down all the knowledge of all the countries of the whole earth into a book of, say, 160 pages, with the result that it needs much intellectual diluting to be even palatable or digestible. The geographic readers have been a great boon to teachers of elementary geography, yet more are sorely needed. The good teacher must be superior to any text, but excellent books are invaluable.

To aid in solving problems found in the field and in books a laboratory is necessary. Field excursions alone can rarely give the answers to problems which arise as to the genesis of the forms of the earth which we find around us. We see a valley and may trace its circuitous path from its source to its debouchure, but the process of valley-making is so slow, except during severe storms, that we cannot catch nature in magnified action. Hence the physical laboratory is a necessity for the understanding of physical processes. But the pupil himself should have the problem which he has found in nature and brings to the laboratory for solution. Crude apparatus which the child understands and can easily manipulate may be of greater value in experimentation than more refined materials. In the use of a hose and a hole in the ground the child may find greater scope than in an expensive laboratory. The young children love action; hence laboratory experiments are not only fascinating to them, but intellectually productive.

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There is, perhaps, no greater evidence of the progress in geography teaching than the advance in the use of maps in all the schools. Yet we regret that what Rousseau said a century and a half ago is applicable to too much of our teaching to-day.

"In every study signs are worthless without the idea they are to represent. Notwithstanding the child's study is confined to signs, it never becomes able to understand the things themselves. While one endeavors to give him an acquaintance with the earth, he makes the acquaintance of the map; he learns the names of the cities, countries and rivers; to the child they are nowhere except on paper."

If you doubt the correctness of the above statement as applied to present educational conditions, try the experiment upon a group of people of naming different places on the earth's surface, letting the hearers describe the first images which come into consciousness. I feel a confidence in saying that a large percentage of any gathering, geographers excepted of course, will see a map instead of the reality, for places they have never visited. Many noted teachers argue that they must see the map first, then force it out of consciousness by the image of the things or places for which it stands. This appears to be an intellectual extravagance. We cannot, I believe, place too high a value upon maps. Civilization could not exist without them, but to encumber the minds of helpless children with images of parti-colored maps, which always appear in consciousness instead of the correspondence to the real country or city, is, it seems to me, little short of a pedagogic crime. We cannot help agreeing with Rousseau in what he says in "Emile":

"You want to teach the child geography, and you seek for globes, spheres, maps, and a host of apparatus! What is the good of all these representations? Why do you not begin by showing him the object itself, so that he knows at least what you are speaking to him about? . . . . After all, it does not so much matter that he should know exactly the topography of the country as how to teach himself about it; it matters little whether he have maps in his head so long as he understands well what they represent and has a clear idea of the art necessary to make them. Behold already the difference between the knowledge of your pupils and the ignorance of mine! They know their maps; he makes them."

It is through making maps of regions visited that the child understands conventions used in map-making. He may make a simple road map showing the direction of travel upon an excursion, or may model the relief seen in sand, or represent it by shading or hatching lines, or show it by contours, or by the international color scheme; and by so doing he gains the alphabet of maps, which is one of the highest accomplishments of the geographer.

Map-making is one of the oldest of the arts. Hence, from the history of its development we may get pedagogic instruction. Among primitive people the necessity for maps found a satisfactory response long before writing was invented. Stanley tells of the aid he received from the Uganda, who made relief maps of their country in the sands along the lake-shores. Travelers in every part of the world have acknowledged a similar indebtedness to the untutored natives, from the islands of the South Seas to the frozen shores of Greenland. Finding that fixed maps could not meet the needs of the hunter, the warrior, and the seafarer, they have shown great ingenuity in the manufacture of portable maps.

The Micronesians, of Marshall Islands, made maps of their islands by fastening stones or shells to a background of woven splints of palm, the size and location of the shells or stones corresponding to the area and position of the islands. They expressed their knowledge of hydrography by widening the splints where the swells or waves increased, as would be the case on nearing land. Captain Cook paid high tribute to the cartographic ability of the South Sea Islanders. He told of his successful cruise through forty degrees of longitude among the Australian Archipelago under the guidance of Tupaya, a native of Tahiti. The Ainos of Japan, and the Tunguses and other tribes of Siberia, have won the gratitude of travelers by the maps which they have made for them. Franklin, Parry, Hayes, and other Arctic explorers have expressed their appreciation of maps made by the Eskimos. The entire Aztec country was mapped when the Spaniards reached Mexico, and these maps were of such excellence that Cortez traveled hundreds of miles by their guidance. They represented mountains, rivers, towns, forests, and political divisions with much detail and accuracy. The Peruvians were also quite advanced in the art of cartography when stricken by the Spanish. They possessed relief and political maps of their country which were of great value to their destroyers.

Economic interests seem to have been a great stimulus to the ancient as well as to the modern map-makers, for the oldest map known to be in existence is one which represents a mining district in Nubia, made during the reign of Rameses II. It represents the mountains and valleys, showing rocks which were rich in ore and those which were barren, not omitting the wells and the few scattered trees along the road leading into that desolate country.

The great problem of map-making with our students, as well as in the evolution of cartography, has been to give graphic expression of geographic facts consistent with an assumed convention. While we may smile at the maps of the Middle Ages, which contain pictures of mountains, houses, men,

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and imaginary monsters, yet we must commend the motive which prompted this grotesque representation, for it was a direct appeal to the imagination, and a map which does not arouse the imagination fails in its purpose.

Hereford's very fanciful maps, which gave little heed to the restraining influence of truth, but reveled in delightful imagination, when knowledge was exhausted, lays high claim to usefulness, for to it is imputed the honor of so arousing the imagination of Milton that his poetic fancy gave *Paradise Lost* to the world.

The progress of map-making has been in the direction of greater truthfulness, which also means greater usefulness, but the attempt to be truthful and at the same time graphic has been the maelstrom which has engulfed many cartographers. Those who are striving for accuracy alone in expression cry out against their fellows who are working for more dramatic representation; unwarranted exaggeration is the persistent charge. Yet the fanciful maps of the Middle Ages were more truthful in intellectual result than the best scientific maps of to-day that arouse only their correspondence in consciousness. But the fault is not in the maps, but in our inability to read the symbol.

It goes without saying that everything which tends to fuller geographic concepts aids in the interpretation of geographic symbols. The ease with which the untrained geographer reads a map depends upon its graphic qualities. Hence reliefs, shaded, and hachure maps offer fewer difficulties to beginners than contour, political, and those made according to the international color scheme, or other conventions. As has been said, the mapping of the region visited, using the different conventions which obtain in maps in daily use, is the surest way of understanding the symbols employed, but copying of maps, considered from the educative standpoint, has little, if anything, to commend it and much to condemn it. There is no mental activity in such a process, and much time is squandered which could be spent to better advantage.

If the student, in expressing his geographic concepts, is required to use a convention differing from the one employed in the map he has been studying, the demand will force him to interpret the map into terms of reality. If he has been studying contour maps, he should represent the relief of the area studied by modeling or by drawing with hatchure lines, by shading, or by the use of some color scheme.

Progress in field and laboratory work, and the use of pictures, models, maps, and charts, in teaching geography are not the only signs which herald its progress. We are now beginning to see the relation which exists between the sciences and history. The influence of physical conditions upon the

biological aspect of the race, which was so strongly brought out by Darwin and Lamarck, is now being applied to social relations. This new movement, as we wish to term it, was advocated by Herder two centuries ago when he said:

"How does it aid a youth if he merely knows what has happened and cannot locate events? Only through the aid of geography will it become clear to him why certain people had to play a rôle upon the historic stage and could play no other; why sciences, inventions, and arts—indeed, the whole civilization—took the course it has taken and no other. Geography is the basis of history, and history is nothing but the geography of times and nations set in motion."

John Smith, in his history of Virginia, published in 1623, says:

"For as geography without history seemeth a carkasse without motion, so history without geography wandereth as a vagrant without certain habitation. He who studies the one without the other will understand neither. Who despises both should live like the mole under the earth."

No historian of to-day would dare to claim a supreme indifference to geography. Man cannot go entirely beyond his physical environment, either biologically or socially. The effect of climate on the physical, mental, and moral condition of individuals is everywhere admitted, and the influence of topography and native products upon humanity cannot be denied. Although geography has had a great influence upon human development, it furnishes only one part of the interesting story. It is true that the great fertile flood plain of the Nile, surrounded by a nearly impassable barrier, the desert, made Egypt's civilization one of the greatest which has blessed the face of the earth, but its decadence can hardly be attributed to geography. The abundance of marble, we now recognize, gave plastic art to Greece; and the geologic fault which made Wolf's cave possible changed the history of North America. Almost every social custom has a geographic basis.

With the increase of knowledge in these various directions has come the difficulty of selecting a course of study. It is impossible now for any individual to encompass the known geography of the world. Hence what not to teach is as important as what to teach. We cannot select a certain number of facts and say these facts are important, hence should be learned, because the important facts vary with every locality and, we may say, with every division of time. It may be that Hawaii seems important because of her present relation to us, but the world is gradually becoming so closely connected that it is impossible to decide who is our neighbbor.

It is true that if we would be one with society, we must constantly feel the pulse-beat of social life. And the great industrial movement which is

now sweeping everything before it, bringing science, art, literature, oratory, and the bayonet to its aid, cannot and should not be ignored; but it should not be given first place in our consideration. So great is the power of this movement that it can turn the heads of the wise and good, as I had evidence in India. I heard a man who is said to be one of the most learned and wisest of Anglo-Indians argue eloquently and feelingly in favor of the opium trade in India. He had lived in that country fourteen years, traveling yearly from one end of the country to the other, collecting material for a great museum of which he is director; but he believes opium is of great value to the country. The glaring light of commercialism has blinded his ethical sight.

Since knowledge *per se* cannot be made the guide to the selection of a course of study, we must seek for it elsewhere. It is in the principles which govern the formation of the landscapes, and those which determine the distribution of peoples, their habits and customs, that we find relief. These, if properly mastered, become the keys which unlock the abstruse geography problems. The ability to interpret landscapes, to see their relation to cultural conditions, to use geographic symbols properly—pictures, models, charts, and literature—must in this day constitute the equipment of the geographer.

A course of study intended for an entire city or country can only designate the very broadest lines of study. For it is just as impossible for the suburban schools to use the same course of study as the schools in the congested districts of the same city, as it is for the children of Jamaica to study the English botanies, which they have attempted with failure.

It is impossible to realize our ideals in teaching so long as the "factory system" obtains in our schools. No teacher can turn out forty pieces of humanity yearly, each bearing the same stamp, and not do violence to them and her better self.

Much of the departmental work is only "piece work"; it is not related to the life of the child. We need more handmade, hand-modeled educational results; less recitation of pedagogic platitudes and more execution; more time spent in teaching the child and less in teaching the subject. Then the child will grow into an appreciation of the harmonies of nature, man and natural law.

EDITORIALS

CAUSE FOR DELAY IN PUBLICATION

IT is with great regret that we have to announce that the Journal will probably be delayed beyond the regular date of issue for the next few months, as was the October number. This delay is not due to the Editor or printer, but to a strike of the typographers which has made it impossible to get the Journal through the press in the usual time. It is impossible now to say how soon the conditions can be improved. We therefore ask our readers to be patient and not to think that their names have been overlooked in mailing, if the Journal is not prompt. The Journal will appear as near to regular date of issue as possible and every effort will be made to make the delay less serious as the months go on.

THE NECESSARY MAP EQUIPMENT FOR A SCHOOL-ROOM

It is a well-known but extremely unfortunate fact that a great majority of the public schools in this country are poorly equipped with the necessary maps for class-room use. In many cases maps are absolutely lacking, in other cases there may be one set of maps for a school building, or perhaps each class-room may have a few maps, many of them old, worn and out of date.

To equip all the schools of a large city adequately with maps is extremely expensive, but on the other hand maps are a long term investment and the cost per year for a complete equipment would be small.

For the best work in geography, history and literature every class-room above the third grade ought to have a Mercator Map of the World, a series of political maps, one for each continent, and physical maps of the United States and Europe. The world map should show the ocean currents and the International Date Line as well as political features. It would be well also if it showed ocean sailing routes and cable lines.

Any class-room ought to have as a minimum equipment a Mercator Map of the World, a political map of the United States, and maps of the continents to be studied in that grade. Less than this is more than inadequate, it is a shameful neglect of necessities.

These maps should be the permanent property of the class-room and should not be allowed to go from the room. Neither should two rooms of the same grade be expected to use the same maps at the same time.

All maps in any school should be mounted on rollers of uniform length, so as to be readily moved from one room to another, thus making it possible for maps temporarily needed to be easily and quickly changed from room to

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room. Maps should be rolled up when not in use so that they will be kept clean, and so that their features will not be so familiar to the pupils that they will think they know everything the maps have to show them.

Every school-room should also have a political globe at least twelve inches in diameter. This globe should be up to date, and not twenty years old as are some of the "new" globes to be secured in the market. Every school building should have one of two blackboard globes twelve inches in diameter for use in studying world features like latitude and longitude, ocean currents, wind systems, etc.

The minimum equipment is not expensive and should be possible in any large city. Teachers should make it clear to "the powers that be" that maps are absolutely indispensable, not only in geography, but in teaching history, literature and current events. Much of the objection to buying maps is due to the fact that superintendents and purchasing agents think the necessary expenditure is large for any one subject. If it can be shown that maps are necessary in many subjects less objection will be made. A series of maps available and used every day in the year will cost no more than a piece of striking apparatus to be used in one topic only for a brief period annually. Money will often be readily given to purchase apparatus to be kept in a case most of the time. Why should this money not be invested in apparatus to be used every day? Why should not teachers have maps and globes instead? Any teacher ought to be able to make her demands so forcible from the standpoint of relative utility as to be able to persuade a superintendent or school committee to buy maps rather than new pieces of apparatus that have not yet proved their general usefulness.

HOW TO USE A GLOBE

A globe is so necessary a thing in school work that pupils and teachers should become so well acquainted with it that they will not handle it as they would a delicate and valuable piece of bric-a-brac. In teaching the seasons and similar phenomena the globe should be held so that the north pole will point toward the north star in order that the relations of earth and sun may be most accurately represented. In teaching the continents, the land and water hemispheres, the winter and summer hemispheres, etc., the globe should be in the best position for bringing out the desired points. If children have the globe presented to them in a variety of positions, they will be less likely to think of the world as a hemisphere, and will not think that people in the southern hemisphere live with their heads hanging down.

RECENT PUBLICATIONS

THE ORGANIZATION OF OCEAN COMMERCE. By J. Russell Smith, pp. viii+155. Publications of the University of Pennsylvania; Selling Agents, Ginn & Co., Boston, Mass., 1905.

An exceedingly interesting monograph dealing with ocean commerce and containing a great deal of geography,. The chapters on Routes and Shipping, and Chapter xii on Ports and Harbors, are especially valuable to teachers.

THE PHILIPPINE ISLANDS. By Fred W. Atkinson, pp. 426, Ginn & Co., Boston, 1905. A splendidly illustrated popular account of the Philippine Islands by the First General Superintendent of Education. The chapters on Climate, Commercial Geography and Peoples are particularly valuable for reference work or supplementary reading in the higher grammar grades.

THE BONTOC IGOROT. By Albert E. Jenks. Volume I of the Ethnological Survey Publications of the Philippine Islands, pp. 266, Manila, 1905. A profusely illustrated descriptive volume dealing with the physical features, the customs and industries of the Bontoc Igorot. A reference volume for libraries.

EARLY WESTERN TRAVELS. 1748-1846. Edited by Reuben G. Thwaites; Vol. XIX, including Letters from the West, by George W. Ogden, Sketch of a Journey through the Western States in 1827 by W. Bullock, Commerce of the Prairies, 1845, by Josiah Gregg, pp. 349. The Arthur H. Clark Company, Cleveland, Ohio, 1905.

The three reprints included in the volume noted above are all entertaining reading, but the section by Josiah Gregg is especially attractive. It gives a splendid account of the manner of travel along the Santa Fe route and of the daily doings of a wagon train. The chapters on Early New Mexico give a very picturesque account of life in the Southwest.

AFRICA. By Frank G. Carpenter. Carpenter's Geographical Reader, pp. 336, American Book Company, New York, 1905.

The final volume in the Series of Geographical Readers written by Frank G. Carpenter, like its predecessors, is a narrative of personal observations and experiences, written in a readable style, in spite of the choppy sentences, and well illustrated. We note that the author calls the Congo Independent State the Kongo State, in spite of authority.

Undoubtedly this volume is the best supplementary volume on Africa available in the United States.

INDUSTRIAL HISTORY OF THE UNITED STATES. By Katharine Coman, pp. xxiv+343. The Macmillan Company, 1905.

An excellent volume of reference for teachers who would understand the present day commercial geography of the United States.

STATISTICAL ATLAS OF THE TWELFTH CENSUS OF THE UNITED STATES. United States Census Office, Washington, 1905.

An invaluable reference volume for libraries, on the results of the 1900 Census in regard to Population, Agriculture and Manufactures.

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ARTICLES IN THE CURRENT GEOGRAPHICAL MAGAZINES

The Geography of American Cities, W. S. Tower, American Geographical Society Bulletin, October. An interesting and valuable summary of the reasons for growth and relative rank of the leading American (United States) cities, grouped as Commercial Centers, Political Centers, Social Centers and Health Resorts.

The Panama Canal, Rear Admiral C. M. Chester; Progress on the Panama Canal, G. H. Grosvenor; The Great Canals of the World, National Geographic Magazine, October. Illustrated popular accounts of the work on the Panama Canal to date and a summary of the history and importance of the great canals of the world.

Exploration and Survey with the Tibet Frontier Commission, Major C. H. D. Ryder. Illustrated account of the itinerary of the Tibet Frontier Commission.

The Field of Geography and Some of its Problems, Sir W. J. L. Wharton. A summary of recent progress in geography. The Geographical Journal, October. Annual Geographical Bibliography, 1904.

Annales de Geographie, September. Annotated summary of the principal articles and books on geography published in 1904. Arranged by subject and also by regions. Valuable for reference for geographers and librarians.

Glacial Features of the Surface of the Alps, Albrecht Penck; Alpine Lakes, Hanging Valleys and Carries, E. J. Garwood; Lone Water, A New Zealand Sketch, H. Mason; An Easter Cruise to Greece, E. Ransome; An American Training College Course in Geography, G. W. Hoke. The Geographical Teacher, Summer, 1905.

The several articles listed above are all most helpful to teachers. The last article contains a well selected bibliography of the untechnical literature available in reference to the several physical divisions of the United States.

NOTES

SOME POINTS ON TEACHING GEOGRAPHY.—1. Rely on maps and outlines, not on the text-book.

2. Assign the lesson by topics, not by pages; in assigning map lessons, do so without having a map before you.

3. Encourage pupils to ask questions, and furnish examples within their own experience of the subject under consideration.

4. Let each pupil give in his own language all the information he has on the subject.

5. At the close of a recitation have the pupils tell what has been brought out during the lesson.

6. Emphasize all new facts, and connect them with the former lessons.

7. Insist that each pupil keep a notebook.

8. Talk little during the lesson; let the subject be unfolded by the pupils.

9. Make your questions and answers as you would in conversation; eschew the lecture style of teaching.

10. Have plenty of reference books, use them freely, and encourage your pupils to consult them.

11. Teach your pupils to study a country in the light of its advantages as an abode for man.

12. Begin every lesson with a review of the preceding lesson. Frequently have this review a written exercise.

13. Have progressive maps made, to be filled in as the lesson proceeds.

14. Encourage individual work; assign subjects to different pupils to be reported on at the next lesson.

15. Use a dissected map of the United States for drill exercises in form, relative size, and position of states.—*The Western Teacher, October*, 1905.

LOCATING A MERIDIAN.—In the following exercises the chief difficulty to be overcome is for the teacher, and lies in the fixing of the local meridian according to directions given.

This involves evening work and had better be done by the teacher with the assistance of some one or more ingenious boys to be found in almost every school and community. The necessary conditions for locating the meridian are a free view of the northern and southern heavens at or near the school house; a support from which to suspend two plumb lines a foot or two apart; and the time of the evening when certain stars of the northern heavens are in a vertical line above each other. The constellations Big Dipper and Cassiopeia, together with the North Star, are familiar objects to nearly every one. When the stars marked in the accompanying diagram are found by sighting across one of the plumb lines to be directly over one another, adjust the other line so that these stars are in the common plane of the two lines. The smaller the cords and the heavier the weights the better. It may be necessary to have each weight submerged in a pail of water to prevent swinging. It may be necessary, too, to have a lantern that the cords may be seen, especially when indoors. By sighting across these lines from north to south the passage of any heavenly body across the meridian south of the zenith is readily timed.

By having a helper stationed ready to announce the coming to the meridian of any star agreed upon, the teacher may readily adjust *within the school-house and at a south window* two other plumb lines suspended from the casing or from the ceiling so that the same star at the time of its culmination is seen in the plane of such lines. These may then be permanently fixed in position for use indoors at any time, day or evening, as a meridian plane.

(Exs. I) By the use of a watch, known to be a good time-keeper, de-

termine the interval in hours, minutes and seconds between the passage across the meridian of any selected star one evening and of the same star the next evening,—the Stellar Day, and the exact period of the earth's rotation. Repeat with several stars, or with the same star for several different times, taking the average of these values as a final result.

(Exs. II) By the use of a smoked glass to protect the eyesight, take the mean of the times shown by the watch when the sun's west edge comes to the meridian and when the east edge passes it. This will be the instant of the sun's center on meridian. Get the interval till the next day when its center is again on the meridian as the length of the true solar day. Maintain these observations for length of solar days for once a week through several months, and tabulate the results. Note that there is not only variation from time to time in length but as well a regularity of increase and of decrease. Mention should be made here of the fact that as the path of the earth's revolution about the sun is somewhat elliptical, with the sun as one of the foci, so the earth's rate in its orbit varies, being greater when nearer the sun. Variation in lengths of solar days arises from these causes.

Attention should be called to the fact, too, that with the natural unit—the day—variable in length, no clock counting off time units of uniform length can keep with the sun. There would of necessity be continual change in length of pendulum, the division of the day being always into the same number of hours, minutes and seconds. Only on certain days in the year do clocks show noon when the sun is on the meridian. Clocks running with uniform rate keep an average (or mean) solar time, and show twelve o'clock noon when the sun would be on the meridian if solar days were always of the same length. This difference between clock time (mean solar time) and true solar (sun-dial) time is given in the almanacs as *sun fast* (coming to meridian before twelve by the clock) and as *sun slow* (coming to meridian after twelve by the clock).

[Just how much of instruction like the above shall accompany the observation work of the natural phenomena of the daily life of man must of course depend upon conditions of which the teacher is to be judge. No attempt is made in any of these nature studies to parcel out the work by grades. This is best done by teacher or superintendent.]—*The Nebraska Teacher, October,* 1905.

THE GEOGRAPHY LESSON.—A geography lesson often furnishes material for a future drawing, language or spelling lesson. The following suggestive words, based on the study of Holland, will furnish material for such lessons: Wind-mills, embankments, skates, sleds, art galleries, wooden

shoes, boats, Rembrandt, canals, dykes, The Hague, poem, etc. As the child recalls the word, the teacher can write it on the board. The teacher can suggest any special word that has been omitted. This can be applied to any state or country.

"Interest must be excited, faith inspired, mind dealt with." Many little devices, such as journeys, letters and puzzles, using geographical names, can be used to awaken interest. The children delight in tracing the course of a ship, naming the ports where it will stop, the goods taken on, those put off, etc. Make a promiscuous list of points of interest, cities, rivers, mountains, lakes, etc. Classify as to: What is it? Where is it? Do not use any device or method too constantly. "Variety is the spice of life."

The cause and effect, the influence of environment, climate and such topics, should be kept in mind, but not entered into too deeply, for the higher grades can give more thorough attention to these phases. The *awakening,* the *guiding,* should be the central thoughts of this grade.

Some one has said, "The first requisite for the successful teaching of this subject is a spirited and intelligent teacher; a wide awake, magnetic spirit, who will truly be a guide to the pupils, through their journeys and investigations, infusing life with every stage of advancement."—*Ohio Educational Monthly, October,* 1905.

METHODS FOR DETERMINING DIRECTION.—An examination of several thousand grammar school graduates, coming from a large number of public and private schools in various portions of the United States, has shown that a large proportion of such pupils have but little or no knowledge of direction or of the methods used in determining it.

To many adults, as well as children, the expressions "the north side of a house" or "the east side of a street," have as little meaning as would the same ideas uttered in the Japanese language.

Many persons can not locate the points of the compass without the use of that instrument, of whose variations and inaccuracy they have but little notion.

To the traveler, the mariner, the woodman, and all persons engaged in rural occupations the ability to determine direction at any time or place is a matter of prime importance; even to the town dweller enough cases arise requiring a knowledge of direction to justify spending considerable time in the lower grades in studying this fundamental part of the common knowledge that everyone should possess.

One of the simplest methods and the one which many teachers seem to regard as the only necessary one is to face the rising sun, calling the direction in front of you east, that back of you west, that toward your extended

right hand south, and toward your left hand north. By facing the setting sun these directions are of course directly reversed with reference to the corresponding portions of the body.

A little observation will show that this is a crude and inaccurate method; for only at the time of the equinoxes, March 21 and September 21, does the sun rise directly in the east and set directly in the west, and in winter it rises many degrees to the south, and in the summer many degrees to the north of these cardinal points, attaining its greatest distance from due east at the time of the solstices, June 21 and December 21. In order to realize how great are the changes in the position of the rising and the setting sun at different times in the year, children should be required to note where the sun rises and sets with reference to the buildings, trees or mountains in their vicinity. The variation of these positions will, of course, make a great difference in the direction of the morning and evening shadows—the winter shadows at these times being cast to the north of an east and west line, and the corresponding summer shadows to the south of this line. The midsummer sunshine on the north side of a house at these hours should also be noted. Children should be taught to determine the time of day by the shortening or lengthening of the shadows before and after noon. An accurate method of determining true noon is to note the exact moment when the shadows cease to shorten, on any day in the year. The sun is then due south, and has attained its greatest height for that day. In our latitudes the shadows it casts at this time are pointing due north, and a perpendicular to this line will give us a true east and west line. From the time of day that the shadows occupy a north and south line, such a line is called a noon-mark or a meridian mark (*meri*-middle and *dies*-day). In locating this noon-mark it should be constantly remembered that there is often a great difference between the mean solar noon of the clock and of the true noon, which is the crossing of the meridian or the culmination of the sun—a difference sometimes of over sixteen minutes. It should also be remembered that unless one is directly on the meridian from which standard time is calculated, that the difference between local and standard time may cause an apparent discrepancy. City children should be taught how people in remote rural districts regulate their time-pieces by adding or subtracting to the time of true noon, indicated by the falling of the noon-day shadow on the noon-mark, or on the proper place on the sun dial, the number of minutes which the almanac says that the sun is fast or slow for that day.

In America we have recently begun to teach a method which has been taught in Germany for many generations. If we hold a watch, face up-

wards, with the hour hand pointing to the sun, the south point will be half way between the twelve o'clock mark on the dial and the place toward which the hour hand points. At noon, there is of course no difference in these two directions. Greater accuracy may be obtained by placing the watch on a board, into which a needle is so placed as to make its shadow cover the hour hand at the time of observation.

One of the most ancient and best methods of determining direction is by observation of the North star. The children should be taught to locate the familiar constellation of the Big Dipper, otherwise known as Ursa Major, or the Big Bear, and then, by drawing a line through the two stars forming the side of the dipper on the opposite side from the dipper handle, and in a direction away from the bottom of the dipper bowl, the position of the North star, or Polaris, may be found by looking for the first fairly bright star on the line thus determined. This star receives its name because it is the nearest of any bright star to the place in the heavens directly above the north pole of the earth, and hence the center of the apparent revolution of the stars. Being about one and a quarter degrees away from the true pole, the accurate determination of true north depends on careful measurements of the mean of the various positions of Polaris. Properly defined north is direction toward this north Celestial pole, and south, direction away from it, east being the direction toward which the earth turns on its axis, and direction toward which the planets and their satellites circle around the sun; and the west is the direction toward which the sun and the other heavenly bodies make their daily apparent journeys.

When the northern heavens are clouded, the south point of the horizon can be located by noticing the place where the stars seem to stop in their ascent in the heavens, just before the descent toward the western horizon begins.

In the newer portions of our country the system of land surveying makes the determination of direction a matter of the greatest simplicity. With rare exceptions, as when the course of a mountain ridge or a large stream may determine their courses, all roads and boundary fences run with the cardinal points of the compass, which also determines the directions of the walls of buildings, which are naturally those of the adjacent roads. A marked exception to this rule is found in the course of the streets of the older portion of Denver, which do not coincide with any prominent direction, although the newer portions of this city have their streets running as nearly north and south as the converging meridians will permit, and the intersecting streets have a due east and west course.

Plants in their efforts to secure the greatest amount of sunlight, or to

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avoid the excess of light and heat, often give us good indices of direction. The stimulating effects of direct sunshine cause a growth of leaves and branches on the northern side of a tree—a growth so great as sometimes to make the tree top-heavy, resulting in its overthrow in wind storms, especially when the supporting surface roots have been injured by forest fires. On the other hand, plants like the violets, mosses, and lichens which desire to avoid loss of their watery contents will seek the shady, northern side of a tree or a rock. At night wood-men find their way by feeling for the moss and lichens on the north side of trees. A number of plants whose leaves can not stand the full force of the midday sun secure protection by presenting the edges of their leaves to the noon-day glare, thus giving the plant a curious flattened form in a north and south plane, giving origin to the name Compass plants. The common prickly lettuce of our autumn fields seems to make efforts to become a compass plant. The difference in the amount of water held in the soil on the northern and southern sides of valleys often determines the presence or absence of many plants, especially in the semi-arid regions of the West. The greater length of time that the snow lies on the ground in the spring enables the north sides of our foothill mesas to be covered with bushes which are absent from the sunny southern slopes. The premature development of plants getting the reflection from a south-facing cliff is a matter of common observation, and a fact that is utilized to grow in northern climes plants not very well adapted to the climate. Some flowers so habitually turn their faces toward or away from the direction of strongest light that even on cloudy days a rough approximation of direction may be formed. Foresters claim various ways of determining direction, by the thickness of the bark on certain sides of trees, or the pointing of the topmost twigs of other trees, etc., some of which methods lack confirmation.

In regions of fairly prevalent winds directions can be determined with a fair degree of accuracy. The determination of direction by the flight of birds in their annual migrations is not as accurate a method as is supposed, as they frequently follow the course of a range of hills or that of some prominent stream, rather than a due north or south direction.

Children should be taught that the compass needle does not point to the north pole, but toward the north magnetic pole, a point which, although it may lie in the same direction as the north pole, is often many degrees to the east or the west of the true north; that the position of this magnetic pole varies from time to time, rendering former compass readings apparently inaccurate. The pupil should also be shown how easily the compass pointer is diverted by the attraction of small amounts of metal, and that often unsuspected causes, like magnetic storms, may cause it to give

false information. Because of these frequent vagrancies, surveyors are constantly on the alert for any causes of disturbance, and are frequently noting the differences between the directions indicated by their instruments and the more accurate direction given by the positions of heavenly bodies.—*Colorado School Journal, Oct.,* 1905.

GEOGRAPHY TEST.—[Sample of principal's test given to grade VII. in one of the Waterbury schools.]

I.

1. Why has New England so many harbors?
2. What caused the extremely rocky surface of New England?
3. What is the chief occupation in New England?
4. Why?

II.

1. Where is the Piedmont Region or Plateau?
2. Give two reasons why this region is good for agriculture.

III.

1. Compare the surface of the Coastal Plains with that of the Piedmont Plateau in height, character of rocks, and soil.
2. How were the Coastal Plains formed?

IV.

1. Toward what bodies of water do all the long, gentle slopes of the continent descend?
2. Where are the short, abrupt slopes?

V.

1. How far does the "Fall line" extend?
2. Name two reasons why there are so many cities situated on this line.

VI.

1. Why is the coast line of the southern states more regular than that of New England?
2. How are portions of the deserts in Colorado, Utah, and Southern California made productive?

VII.

1. Name four states that produce cotton.
2. Where is the greatest mining region in the United States?
3. Name two states noted for their valuable forests.
4. Name two states noted for their production of coal.
5. Name a great wheat-producing state.
6. Where are the "Bad Lands"?

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VIII.

1. Compare the Rocky Mountains with the Appalachian Mountains in regard to height and age.
2. How wide is the great flood-plain of the Mississippi?
3. What is the principal occupation of the people occupying this region?
4. Why?
5. What are levees?

—*The Journal of Education.*

THE TRANS-SOUTH AMERICAN RAILROAD.—The resumption of work on the railroad between Buenos Aires and Valparaiso is announced. The completed line will be 893 miles long, and in the Andes region it will cross elevations over 10,000 feet above sea-level. The only section not yet built is in the Chilean Andes, and is 29.76 miles in length. When this very difficult part of the road is finished only a day and a half will be required for passage between the capitals of Argentina and Chile.—*Amer. Geog. Soc. Bull., October,* 1905.

A METEOR AT HOLYOKE, MASS.—On October 13, 1905, a number of people in Holyoke had an opportunity of observing a very rare phenomenon, that of a full fledged meteor "shooting" at such a time of day that it left a brilliant line of light marking the path which it had taken through the sky in its course toward the earth.

It was about 5.20 P. M. and the sun had just set behind a neighboring hill, leaving a most beautiful bank of golden color in the western sky. It was dusk and as the meteor fell in the west it was very easily distinguished.

The attention of all who observed the meteor was immediately arrested by a bright streak of light which was left in the wake of the meteor extending straight up about 10 degrees from the point in the horizon where the meteor had disappeared. It was very evident that this streak marked the path which the falling meteor had taken.

This streak remained for fully ten minutes until the light from the fast sinking sun had so far weakened that the line gradually disappeared.

Evidently the conditions were ideal for such a phenomenon. It was dark enough to make the meteor stand out against the sky and enough sunlight still remained to light up the meteoric dust and mark the trail.

It was a novel and instructive sight to all who witnessed it and one that we shall remember for a long time to come.—*M. D. C.*

SOME TYPE LESSONS AS LABORATORY WORK IN GEOGRAPHY.—I. *Waters of the Atmosphere.*—Exp. 1.—*Vaporization.*—In each of the following experiments as performed observe (obs.) what occurs.

(a) Cover the bottom of a saucer one-eighth inch deep with water; leave exposed to the air for a day.

(b) Thoroughly wet a piece of cloth, as a handkerchief, with water. Hang up freely exposed to the air for several hours.

(c) Boil a very little water in a test tube (tt), noting any change in the quantity of water from time to time.

(d) Hold over the boiling water in (c) a wide-mouth (w. m.) bottle with dry cool sides.

Infer (inf.) from these several experiments (1) what becomes of the water; (2) at what temperatures vaporization of water occurs most rapidly; (3) some sources whence the supply of moisture in the air is maintained; (4) under what conditions vaporization from land and water surfaces will go on rapidly; (5) the relation to each other of the processes of vaporization and condensation; (6) the distinction between a vapor (as of water) and a gas or mixture of gases (as of air); (7) the usual change whereby atmospheric moisture is condensed; (8) the different conditions involved in formation (a) of dew and rain, (b) of white frost and snow, (c) of fog and cloud; (9) the cause of the appearance of "steam" at the mouth of a tea kettle of boiling water, and then its disappearance a little farther outward.

Inf. why in some regions of earth sudden and even extreme fall in temperatures may cause no precipitation either of rain or snow. What must be true of the general character of a region and of its fitness for habitation when the atmosphere is largely destitute of moisture? For inland regions far distant from large bodies of water how account for the supply of atmospheric moisture to provide ample rainfall. Explain (1) why in winter we sometimes can "see our breath," and at other times cannot; (2) why the clouds of a morning sometimes thin out and disappear as the sun rises higher and higher; (3) why as it continues raining the clouds often break away giving place to clear skies.

Exp. 2. *Latent Heat.*—Heating slowly, stir continuously with a thermometer some ice cold water containing small lumps of ice. Heat till the ice is melted and the water boils. Obs. the temperature (1) at the beginning; (2) from time to time while the ice is melting; (3) during the time till the water boils; (4) during the boiling as the water is heated more and more.

Exp. 3. Obs. the temperature of a thermometer. Wet the bulb with alcohol (or water) and wave back and forth in the air. Obs. the lowest temperature it records. Repeat, having a tuft of cotton tied on thermometer bulb, wetting tuft with alcohol. Inf. what becomes of the alcohol. Recall by what means vaporization of liquids has been accomplished before. Inf.

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explanation of the thermometer changes. Inf. concerning this heat of vaporization when the vapors are condensed, changing to liquids.

Exp. 4. Let an iron spoon be heated hot; then into it pour water a little at a time. Obs. what change occurs (1) in the water; (2) in the temperature of the spoon. Inf. what becomes of the heat of the metal largely. Inf. (1) the part that vaporization plays in the temperature of any region intensely heated by the sun as during our days of summer; (2) the probable temperature of land surfaces largely destitute of water under a summer's sun. What in part explains the refreshing coolness that frequently follows a summer shower? Explain the part played by the latent heat of vaporization in delaying warm weather in the spring. Explain the heating of rooms and buildings by steam.

Apparatus and Supplies.—Test tubes; w. m. bottle; thermometer; ice; alcohol (wood alcohol will answer); tin cup; alcohol lamp; spoon.

Books for the School Library.—*Gregory and Simmons, Elements of Physics and Chemistry, Part IV, Macmillan Co., 50 cents; *Major, Domestic Science, Blakie & Son, $1.25; Tyndall, Forms of Water, Appleton, $1.50; *Tarr and McMurry, Geography, Part I, Macmillan Co., 40 cents.

II. *Winds and Weather.*—Exp. 1. *Pressure Exerted by the Atmosphere.*—Tie in loose folds some sheet rubber over the large end of a student lamp chimney, making air-tight the rubber covering. Blow into the open end of the chimney and obs. the rubber. Compare the amount of air in the chimney now and before. Inf. the condition of the air within. Compare its condition with that of the air without. Inf. what the air within does to the rubber. Inf. why the rubber is pressed outward.

Exp. 2. With the same apparatus suck some of the air out and obs. Exhaust more of the air and obs. again. Compare in both cases the amount of air remaining in the chimney with the amount at first. Inf. why the rubber was forced inward in both cases and why more in one case than the other. Inf. the relation between the pressure on each side of the rubber and the density within and without. With the density of the surrounding air remaining the same, inf. how the greatest possible inequality of pressure on the sides of the rubber covering might be secured.

Exp. 3. Closely fit into a w. m. bottle a rubber stopper through which is passed two glass tubes, one long the other short and bent at a right angle. Let the long tube dip beneath some water in the bottle. Through the other tube blow gently into the bottle and obs. the water in the long tube. Inf. the condition of the air in the bottle. Inf. why the water rises in the tube.

Repeat the experiment, blowing harder, and obs. as before. Inf. the relation between the degree of compression of the air in the bottle and the

*For teacher's desk or class use.

heights of the columns of water. Inf. when the rising column will come to rest. Inf. how long it will remain stationary.

Close the upper end of the filled tube with the finger, remove the mouth, and obs. Exhaust some of the air from the bottle, and obs. the height of the water column. Inf. by what the weight of the water in the tube is sustained.

Exp. 4. *The Barometer.*—Fill a glass tube, at least 30 inches long and closed at one end, with mercury; holding the forefinger close over the open end, invert the tube and plunge the open end under some mercury in an open dish. Remove the finger, and obs. the mercury column. Inf. why the mercury column is thus sustained above the level outside the tube. Inf. concerning the condition of the space above the mercury in the tube. Inf. when the height of the column will become stationary. Inf. the explanation of any change in its height. Measure the height of the column above the mercury level in the dish. As mercury is 13.6 times heavier than water, calculate what height of water column would be supported by the same atmospheric pressure.

Exp. 5. Make a study of a mercury barometer, noting of it (1) the mercury cistern and how the air pressure from without reaches the mercury surface; (2) the heights of the mercury column from time to time, and from what point this measurement is taken in all cases; (3) the provision for reading the height of the mercury column to the fraction of an inch. Inf. the effect of the presence of any air above the mercury (a) upon a rising barometer column; (b) upon a falling column. Inf. the significance of any changes in height of mercury of barometer.

Exp. 6.—*Causes of Change in Atmospheric Density.*—Close a tt with a rubber stopper through which passes a glass tube. Invert the tt and hold the end of the glass tube under water. Heat the tt and obs. the mouth of the glass tube. Inf. concerning the action of the air of the tt. Inf. concerning the density of the remaining air. Allow the tt to cool with the glass tube still under water. Obs. and inf. Inf. concerning the density of air as it cools.

Exp. 7. *Table (by Regnault).*—Weight of a cubic foot of air and of the vapor it contains in grains, with the barometer at 29 inches, and with the temperatures Fahrenheit as follows:

Degrees Fahr.	When Dry	When Saturated with Water Vapor	Weight of Water in Saturated Air
0	604.8	604.1	0.553
32	564.9	561.4	2.128
62	532.7	522.9	6.167
102	494.9	461.3	20.979

In the table note the relative density (1) of dry air and saturated air at the same temperatures; (2) of air as the temperature is increased, both the dry and the saturated. Note the amounts of water vapor held by air as its temperature is lowered.

Inf. concerning the barometer reading (1) in a warm moisture-laden atmosphere; (2) in a cold dry atmosphere. Inf. the probable cause of a falling barometer with temperature stationary or rising.

Exp. 8. *Currents in the Atmosphere.*—Over two holes cut through the cover of an empty cigar box in which all cracks are sealed, set two chimneys made air tight at the bottom by grease or oil. Have a bit of a candle burning within one of these. By means of the smoke from an extinguished match test for air currents at the tops of the chimneys. What is true of the relative temperatures of the air in the two chimneys? Inf. what the air in the box will do because of these conditions. Explain why the air goes down one chimney and through the box. What of the temperature of the warmed air after leaving the chimney? Trace its possible course to make a complete round of circulation.

Let there be in one region of country a warm moist atmosphere, and in some adjoining section a cold dry air. Trace a complete circulation of atmosphere made possible thereby. Inf. for how long this will be maintained. Inf. in what part of this circuit the air current will be along the earth's surface. Inf. when this air current will cease to exist—die out.

It may be well to distinguish among the parts of this circulation by limiting use of the term "wind" to the surface current, as distinguished from (1) the ascending and descending currents; (2) the upper air currents. With such use of the term, inf. (1) where a wind originates (springs up); (2) from what direction a wind blows; (3) where it ends (ceases to be a wind). Inf. at what places in this round of circulation to an observer on the earth there will be no wind—a calm.

With an upward current established, and independent of any temperature and moisture changes, inf. the effect on the barometer readings of (1) an upward movement of atmosphere; (2) one downward.

Exp. 9. *Areas of High and Low Pressure.*—In some parts of the world the sun at noon is directly overhead—in the zenith. At what time of year is there nearest approach to that condition here? The more nearly vertical the sun's rays fall on the earth's surface the hotter is that region.

That portion of the earth where the sun's rays are always vertical reaches east and west around the globe across northern South America, central Africa and southern Asia as well as the oceans lying between. Inf. a result of the continuous intense heating of the surface of the immense water areas of

this region—the Torrid Zone. Inf. three causes combining to make the barometer readings relatively low along the line of vertical rays of the sun—the Heat Equator.

Of these ascending currents of hot moisture-laden air, inf. (1) their directions as upper-air currents; (2) their temperature as they ascend, and a direct result of this; (3) the density of such air following such changes; (4) the tendency in altitude of upper air as it moves from equator northward. In moving over land areas of varying altitude, say the continent of North America, in what regions are such currents likely to touch surface, and moving along such surface be known again as Winds. Inf. concerning the character of such winds as to (1) temperature; (2) moisture held by them.

Were the earth not rotating on an axis this movement of the atmosphere northward from the equator would be due north; but because of such rotation this course poleward is more a northeasterly movement. Where the air of this northeasterly moving current, cold and dry and dense, feeds down continuously, inf. what is likely to be true of the direction across country of the moving condition resulting from this downpour of the upper atmosphere. Inf. concerning the barometric readings of those sections over which in turn this condition (downpour) occurs.

With descending air currents in one section of country what may reasonably be expected in some adjoining section that equilibrium of atmosphere may be maintained? What conditions of atmosphere in any region is likely to favor the development there of an ascending current? Inf. (1) the directions from which winds will blow towards these areas of low pressure; (2) the condition of atmosphere as to a wind at the center of one of these areas. With one of these "lows" to the north of us, were it not for the earth's rotation, a wind from the south would pass us; as it is, such a current enters the S. E. quadrant of the "low;" likewise, what would have been a north wind enters from a northwesterly direction.

Exp. 10. *Weather as Affected by Highs and Lows.*—In this central west the moisture-laden winds are largely from the Gulf, and enter very generally the southeast quadrant of the "lows." By reason of the lessened pressure experienced in such areas and as ascending currents, there is an expansion of such air and a consequent cooling of it whereby the skies are beclouded and more or less of the moisture precipitated as rain or snow. In like manner, the cool dry air from the north and northwest on its way towards a "low" has its capacity for moisture increased as it warms, dissipating the clouds and bringing clear skies and bright sunshine. Inf. concerning the wind direction, relative temperature of atmosphere and appear-

ance of the sky (1) as the advancing eastern edge of a "low" comes over a section of country; (2) when such "low" is central over that region; (3) as its western portion passes. In like manner inf. the successive changes of weather as a "low" forms to the northwest of a locality, moves to the north, and then to the northeast of it; (2) when the "low" is to the southwest, the south and southeast of any locality.

Exp. 11. *Weather Maps.*—From a series of two or three maps showing the progress of typical storm areas, locate and explain the significance of (1) the isotherms; (2) the isobars; (3) the wind directions from a high; (4) the wind directions into a low; (5) the modification of temperature of a whole region by an advancing high; (6) how the isotherms "run" with the lows; (7) the areas of precipitation. Inf. concerning any precipitation in front of an advancing high. Account for wind directions at any point not in accord with the general atmospheric circulation about and into a low, and out from a high. Inf. the significance of the term cyclone as applied to a low, and of anti-cyclone applied to a high. Inf. what conditions largely determine the wind velocities reported at various points.

Apparatus: Student lamp chimney; rubber tissue; w. m. bottle; r. stopper; 2 holes (for bottle); glass tubing; alcohol lamp; mercury; barometer; test-tubes; r. stopper of 1 hole (for tt); cigar box; chimneys; candles; weather maps.

Books for the School Library.—Archibald, Story of the Atmosphere, Appleton, 40 cents; Bigelow, Weather Forecasting, U. S. Dept. of Agr. (Bulletin No. 20), free; Davis, Elementary Meteorology, Ginn & Co., $2.50; Harrington, About the Weather, Appleton, 60 cents; Tarr and McMurry, Geography, Part IV, Macmillan Co., 50 cents—From *Nebraska State Normal School Bulletin,* April, 1905.

JAPAN AT WORK IN MANCHURIA.—Japan's commerce has followed hard upon the heels of its victorious armies. Less than two months after the latter battle, trains were running from Liao-Yang to Mukden over a temporary bridge spanning the Hun River; and regular train service from Port Dalny to the Manchurian capital followed immediately. Thousands of soldiers have been employed in clearing Mukden and the battlefield, to guard against disease when warm weather arrives, and all the sanitary precautions so successful in handling the army have been enforced. Besides finishing the Central Railway through Japan itself, many locomotives have been ordered for both Manchuria and Korea, 157 leaving Seattle on a single steamer; trade is beginning to flourish at Liao-Yang, and already there have been circulated $25,000,000 of war notes on a par with the silver currency. —*World's Work,* June, 1905.

FERDINAND VON RICHTHOFEN AS A TEACHER.—Finally I come to the most important side of his influence, that side which certainly brought him the greatest personal honors and assured the broadest scope to the influence of his genius, viz.: his activity as a teacher in the University of Berlin. To this in particular is due the fact that his conception of Geography as a division of Natural Science, characterized by strictly inductive methods of research, exerted such masterful influence throughout Germany. The world could not sufficiently express its thanks should it be possible to preserve in print, for the use of future generations, the notes taken at various of his conferences and lectures so rich to overflowing with original ideas and brilliant resumes. Yet even such a publication could not supply that part which was the best of all, the inspiring influence of his personality, especially as it manifested itself in the *"Colloquium"* which he founded. This weekly assembling of his students for seminar exercises has long been famous as the hotbed of young talent in Geography, whence has already been drawn a large proportion of the present teachers in Geology and Geography at the German Universities.

Richthofen's methods in his *"Colloquium"* were peculiar. He practically never gave direct instruction, rather he withdrew almost wholly into the background merely guiding the talks and discussions by slight touches and remarks. He rarely voiced a criticism of the paper read and took but slight part in the discussion of it. The chief thing was that he was present, for the force of his personality exerted such an influence that each of us girded himself up to do his best. He never exerted a dictatorial influence in favor of any dogma whatever; insisting only upon fearless criticism, logical arguments and absolute adherence to facts, in all other respects perfect freedom was allowed for the development of independent individuality. The wisdom and fruitfulness of this method is eloquently testified to by the simple fact that his former students, even after they had won independent positions in the world and as investigators, yet always kept in close touch with the *"Colloquium"*; and whenever circumstances permitted they attended its meetings as of old, contributing from the riches of their personal experiences to the intellectual store of the debates. Thus it was that even the most widely different themes found a wealth of information upon them represented among the members of the circle, and the discussions always developed most instructively.

For the same reason, also, Richthofen's *"Colloquium"* became not only a reunion of students of science, but of personal friends. It was a circle whose members held together through years and decades in such a manner as to certainly mark it a unique assembly among University seminars. Here again the cementing bond and ferment of this union was von Rich-

thofen himself. It was but another tribute to the strong human influence of this man's personality, a man not only to be admired but to be loved as few others are, an aristocrat from crown to sole, a nobleman in the highest, most beautiful sense of the word.—Translated from *"Täglichen Rundschau,"* Berlin, 12 October, 1905, by C. Abbe, jr.

THE SNOW HUTS OF THE ESKIMO.—The climatic control of the materials of which human dwellings are constructed has often been emphasized, and the general fact of snow huts in the Arctic, of light construction of leaves and bamboo in the moist tropics, or abobe houses in arid regions, and so on, are well known. The details of construction, however, and the more minute control of climatic conditions, have not, as yet, received adequate attention. For example, in the case of the snow huts of the Eskimo, it appears on the authority of Klutschak, as reported by Woeikof, that these huts, which are arched, are never constructed out of the first snow which falls. The Eskimo waits until successive snow-squalls and high winds have packed the snow down hard. In such cases as this, the density of the snow is not due to the weight of the snow, nor to successive thawings and freezings, as in the case of the formation of the névé, but it is simply the result of packing under wind action.—*American Geographical Society Bulletin, November,* 1905.

NEWS ITEMS

Dr. A. J. Herbertson, one of the associate editors of this JOURNAL since its first appearance as the *Journal of School Geography* in 1897, has been made the head of the School of Geography at Oxford, with the title of Reader in Geography. Dr. Herbertson takes the place of Mr. H. J. Mackinder, who has resigned to devote his whole time to the London School of Commerce. Dr. Herbertson is Honorary Secretary of the Geographical Association and editor of the Association's quarterly magazine, *The Geographical Teacher.*

The Second Annual Meeting of the Association of American Geographers, under the presidency of Professor W. M. Davis of Harvard University, will be held at the rooms of the American Geographical Society, New York City, on December 26 and 27, 1905.